CLAIMS

What is claimed is:

1. A method for summing integrals at a target frequency of a plurality of target frequencies, the method comprising the computer-implemented steps of:

accessing a set of pairs of I and Q correlation values corresponding to a set of data blocks, wherein:

the set of data blocks together make up a sampled data that is associated with a received signal;

each pair of I and Q correlation values from the set of pairs of I and Q correlation values corresponds to a calculated pair of I and Q correlation integrals that are integrated over one corresponding data block from the set of data blocks at a plurality of frequencies from a set of frequencies; and

selecting pairs of I and Q correlation values that correspond to calculated pairs of I and Q correlation integrals that are calculated using a frequency from the set of frequencies that is close to the target frequency to be selected pairs I and Q correlation values;

weighting the selected pairs of I and Q correlation values according to a set of characteristics to produce a set of weighted pairs of I and Q correlation values; and

summing the weighted pairs of I and Q correlation values at the target frequency.

2. A method for summing integrals for a sampled data, the method comprising the computer-implemented steps of:

step A: defining R number of sets of frequencies, wherein:

R is an integer value that is greater than unity;

each set of frequencies from the R number of sets of frequencies is assigned an index that is unique, wherein the index ranges in value from 1 to R;

step B: defining R number of sets of data blocks, wherein:

each set of data blocks from the R number of sets of data blocks make up the sampled data;

each set of data blocks from the R number of sets of data blocks is assigned the index that is unique, wherein the index ranges in value from 1 to R;

step C: defining R number of pairs of data block-frequency sets, wherein:

each pair of data block-frequency sets from the R number of pairs of data block-frequency sets is assigned the index that is unique, wherein the index ranges in value from 1 to R; and

each pair of data block-frequency sets comprises a set of data blocks from the R number of sets of data blocks and a set of frequencies from the R number of sets of frequencies, wherein:

the index of the pair of data block-frequency sets, the index of the set of data blocks in the pair of data block-frequency sets and the index of the set of frequencies in the pair of data block-frequency sets have identical values;

step D: selecting a first pair of data block-frequency sets, wherein the index of the first pair of data block-frequency sets is equal to 1;

step E: for each data block in the first pair of data block-frequency sets, calculating a pair of I and Q correlation integrals at each frequency in the first pair of data block-frequency sets to produce a corresponding pair of I and Q correlation values;

step F: selecting a next pair of data block-frequency sets to be a current pair of data block-frequency sets, wherein:

the next pair of data block-frequency sets has not been previously selected;

the index of the next pair of data block-frequency sets is a next lowest index;

step G: from the current pair of data block-frequency sets, selecting one data block that has not been previously selected from the current pair of data block-frequency sets to be a selected data block and performing the steps of:

step H: identifying a previously selected pair of data block-frequency sets that contains a subset of data blocks to be an identified pair of data block-frequency sets, wherein the subset of data blocks make up the selected data block;

step I: selecting a frequency that has not been previously selected from the current pair of data block-frequency sets to be a target frequency;

step J: from the identified pair of data block-frequency sets, identifying a frequency that is close in value to the target frequency to be an identified frequency;

step K: selecting pairs of I and Q correlation values that correspond to the subset of data blocks at the identified frequency to be selected pairs of I and Q correlation values;

step L: for the selected data block, weighting the selected pairs of I and Q correlation values with weights to form weighted pairs of I and Q values;

step M: summing the weighted pairs of I and Q values over the selected block to form weighted sums of I and Q values;

step N: repeating steps I through N until all the frequencies from the current pair of data block-frequency sets have been selected to be the target frequency;

step O: repeating steps G through O until all the data blocks from the current pair of data block-frequency sets have been selected to be the selected data block;

step P: repeating steps F through O until all the pairs of data block-frequency sets from the R number of pairs of data block-frequency sets have been selected to be the current pair of data block-frequency sets.

3. The method of Claim 2, wherein calculating pairs of I and Q correlation integrals is performed coherently by using a navigation bit information when the I and Q correlation integrals are associated with a received signal that emanated from a global positioning satellite vehicle, and wherein the navigation bit information is associated with the global positioning satellite vehicle.

4. A method for summing integrals for a sampled data, the method comprising the computer-implemented steps of:

step A: defining a first set of frequencies and a second set of frequencies;

step B: defining a first set of data blocks and a second set of blocks, wherein;

each set of data blocks make up the sampled data;

step C: defining a first pair of data block-frequency set, wherein:

the first pair of data block-frequency set comprises the first set of data blocks and the first set of frequencies;

step D: defining a second pair of data block-frequency set, wherein:

the second pair of data block-frequency set comprises the second set of data blocks and the second set of frequencies;

step E: selecting the first pair of data block-frequency set;

step F: for each data block in the first pair of data block-frequency set, calculating a pair of I and Q correlation integrals at each frequency in the first pair of data block-frequency sets to produce a corresponding pair of I and Q correlation values;

step G: from the second pair of data block-frequency set, selecting one data block that has not been previously selected from the second pair of data block-frequency sets to be a selected data block and performing the steps of:

step H: from the first pair of data block-frequency set, identifying a subset of data blocks make up the selected data block;

step I: selecting a frequency that has not been previously selected from the second pair of data block-frequency set to be a target frequency;

step J: from the first pair of data block-frequency set, identifying a frequency that is close in value to the target frequency to be an identified frequency;

step K: selecting pairs of I and Q correlation values that correspond to the subset of data blocks from the first pair of data block-frequency set to be selected pairs of I and Q correlation values;

step L: for the selected data block, weighting the selected pairs of I and Q correlation values with weights to form weighted pairs of I and Q values;

step M: summing the weighted pairs of I and Q values over the selected block to form weighted sums of I and Q values;

step N: repeating steps I through N until all the frequencies from the current pair of data block-frequency sets have been selected to be the target frequency; and

step O: repeating steps G through O until all the data blocks from the second pair of data block-frequency set have been selected to be the selected data block.

5. The method of Claim 4, wherein calculating pairs of I and Q correlation integrals is performed coherently by using a navigation bit information when the I and Q correlation integrals are associated with a received signal that emanated from a global positioning satellite vehicle, and wherein the navigation bit information is associated with the global positioning satellite vehicle.

6. The method of Claim 6, wherein calculating pairs of I and Q correlation integrals is performed coherently by using a navigation bit information when the I and Q correlation integrals are associated with a received signal that emanated from a global positioning satellite vehicle, and wherein the navigation bit information is associated with the global positioning satellite vehicle.

7. A method for estimating a carrier frequency at a target frequency, the method comprising the computer-implemented steps of:

receiving sampled data associated with a received signal;

dividing a range of frequency of interest into a first set of frequency intervals and a second set of frequency intervals;

dividing the sampled data into a set of blocks of data based on the first set of frequency intervals;

for each data block of the set of blocks of data, calculating I and Q correlation integrals associated with the sampled data at one representative frequency from each frequency interval in the first set; and

for every frequency interval of the second set of frequency intervals, determining a corresponding selected frequency in the first set of frequency intervals, wherein the selected frequency is close in value to the target frequency;

selecting I and Q correlation integrals corresponding to each selected frequency to be selected I and Q correlation integrals

weighting the selected pairs of I and Q correlation values according to a set of characteristics to produce a set of weighted pairs of I and Q correlation values; and

summing the weighted pairs of I and Q correlation values at the target frequency.

8. The method of Claim 7, wherein the received signal is from a known signal source.

9. The method of Claim 7, wherein for each data block of the set of data blocks, the step of calculating I and Q correlation integrals comprises calculating the I and Q correlation integrals for each hypothesized delay value over a range of hypothesized delay values.

10. The method of Claim 9, further comprising the step of selecting a trial frequency value for each frequency interval of the first set of frequency intervals for calculating the I and Q correlation integrals.

11. The method of Claim 10, wherein the trial frequency value is a frequency value at a mid-point of each frequency interval.

12. The method of Claim 7, wherein the carrier frequency contains at least one frequency shift that is a member of a set of frequency shifts, wherein the set of frequency shifts include a zero frequency shift, a positive frequency shift and a negative frequency shift.

13. The method of Claim 7, further comprising the steps of:

for each hypothesized delay value in a range of hypothesized delay values, calculating a magnitude of a vector (I,Q) of correlation sums that were previously summed over all the blocks of data for each frequency interval of the second set of frequency intervals; and

determining an estimate of the carrier frequency by identifying a particular frequency interval from the second set of frequency interval that has a highest magnitude calculation.

14. The method of Claim 7, wherein the first set of frequency intervals is a coarse grain set of frequency intervals and the second set of frequency intervals is a fine grain set of frequency intervals.

15. The method of Claim 7, wherein a number of intervals in the first set of frequency intervals is proportional to a length of the sampled data and is based on a pre-selected signal-to-noise ratio.

16. The method of Claim 7, wherein a number of intervals in the second set of frequency intervals is proportional to a length of the sampled data.

17. The method of Claim 7, wherein a range of frequency of interest is based on a pre-selected frequency interval around a frequency of a known signal source from which the received signal emanates.

18. The method of Claim 7, wherein calculating the I correlation integral and the Q correlation integral is performed coherently by using a navigation bit information when the received signal emanates from a global positioning satellite vehicle, wherein the navigation bit information is associated with the global positioning satellite vehicle.